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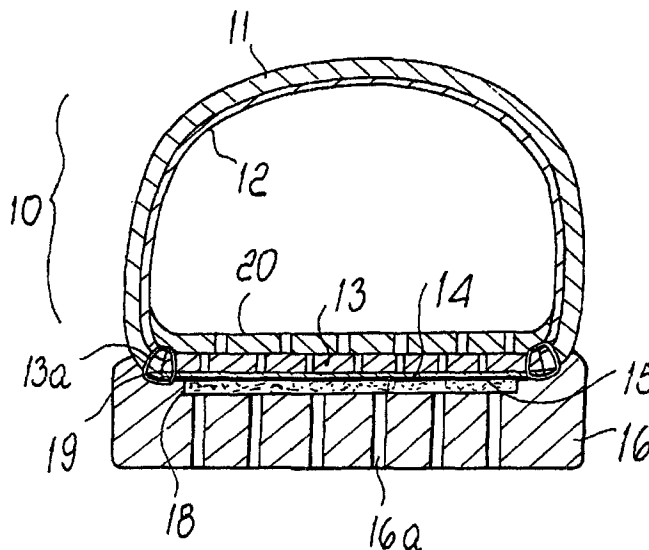
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- (71) Applicant (*for all designated States except US*): **NOTTINGTON HOLDING B.V.** [NL/NL]; 7th floor, Strawinsky laan 3105, NL-1077 Amsterdam (NL).
- (72) Inventor; and  
(75) Inventor/Applicant (*for US only*): **POLEGATO MORETTI, Mario** [IT/IT]; Via Antonini, 7, I-31035 Crocetta del Montello (IT).
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[Continued on next page]

(54) Title: BREATHABLE SHOE



(57) Abstract: A breathable shoe, including: an upper assembly (10, 310, 410) having a breathable upper (11, 311, 411); a membrane (14, 314, 414) made of a material which is waterproof and breathable, and a sole (16, 116, 216, 316, 416) made of perforated elastomer, which are all mutually attached such that the membrane is arranged between the upper assembly and the sole, and the sole is sealed perimetrically to the membrane, in a manner to prevent moisture to enter into the upper assembly from the sole through the membrane, and to permit moisture to leave the inside of the upper assembly through the membrane and through the sole. In one preferred embodiment, the membrane is first attached to the upper assembly so that the upper assembly is a unitary upper assembly including the membrane, and such unitary upper assembly is subsequently attached to the sole.

WO 01/78542 A1



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*For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.*

## BREATHABLE SHOE

### Technical Field

The present invention relates to a breathable shoe.

### Background Art

5 It is known that a shoe, in order to be comfortable, must ensure proper exchange of heat and water vapor between the microclimate inside the shoe and the external one.

This exchange of heat and water vapor, however, must not compromise in any way the impermeableness of the shoe to external humidity or water.

10 Currently commercially available shoes entrust this exchange of heat and water vapor substantially to the upper or to the sole.

As regards the upper, shoes which are perforated and/or provided with linings made of a breathable and waterproof material are currently commercially available.

15 In some models, some parts of the upper can be replaced with materials which are indeed waterproof and breathable at the same time.

In rubber soles, many solutions have been proposed in order to solve the problem of the lack of breathability which is inherent in the characteristics of the material.

20 One of these solutions, disclosed in Italian patent No. 1232798, consists in dividing the sole into two layers with through holes and in interposing a breathable waterproof membrane which is joined perimetrically and hermetically to the two layers.

Variations of this solution occur in subsequent patents, all of which are  
25 in any case focused on dividing the sole into two layers in order to stop external water and dirt in a region which is as close as possible to the surface that makes contact with the ground.

This entails manufacturing complications and in particular prevents the provision of particularly thin soles.

30 In other cases, such as for example in European patent No. 275644, the

entire sole is provided with through holes and is joined at the top with an upper having a bottom surface, which is entirely made of a waterproof breathable material (film of polytetrafluoroethylene porous foam) with the interposition of a protective layer made of porous material.

5 This structure is adapted for shoes whose upper is not provided with the classic methods, such as the ones known as "Strobel", "ideal welt" or "pre-assembled".

European patent No. 103601 also discloses a sole in which delimited regions are completely crossed through their thickness by holes and in  
10 which, in an upward region, a waterproof and breathable membrane is in contact with a substrate made of soft perforated material on which the foot rests; this solution is substantially equivalent to the preceding one and makes it impossible to apply classic methods.

The sole is monolithic with the upper and the entire assembly is made of  
15 plastic and is therefore not breathable.

The regions with holes are separate from the rest and are constituted by removable disks.

Substantially the same situation is proposed by French patent No. 1228239, which discloses a shoe with a sole and an upper made of the same  
20 waterproof but non-breathable (plastic) material, provided with through holes (in both the sole and the upper) and, inside the upper, a bootie made of waterproof and breathable material.

There is also an insole inside the bootie which is made of felt or similar material.

## 25 Disclosure of the Invention

The aim of the present invention is to provide a shoe with a waterproof and breathable sole which can be manufactured with the above cited classic methods (modified appropriately) and is simpler than the ones known in the state of the art.

30 Within this aim, an object of the present invention is to provide a

breathable shoe whose structure entails absolutely no constraints as regards styling and aesthetic research, allowing the greatest freedom to shoe shapes and types.

Another object of the present invention is to provide a breathable shoe  
5 which is meant for both day-to-day use and for sports use.

Another object of the present invention is to provide a breathable shoe whose cost is competitive with respect to the costs of known shoes.

In accordance with the invention, there is provided a breathable shoe and a method for manufacturing a breathable shoe as defined in the appended  
10 claims.

#### Brief Description of the Drawings

Further characteristics and advantages of the present invention will become better apparent from the description of three embodiments thereof, illustrated only by way of non-limitative example in the accompanying  
15 drawings, wherein:

Figure 1 is a cross-section view of a shoe according to the invention in the assembled condition, in a first embodiment;

Figure 2 is a cross-section view of the shoe of Figure 1 prior to final assembly;

20 Figure 3 is a cross-section view of the sole of a shoe according to the invention in a second embodiment thereof;

Figure 4 is a cross-section view of the sole of a shoe according to the invention in a third embodiment thereof;

Figure 5 is a cross-section view of a shoe according to the invention in  
25 the assembled condition, in a fourth embodiment thereof;

Figure 6 is a cross-section view of the shoe of Figure 5 prior to final assembly;

Figure 7 is a cross-section view of a shoe according to the invention in the assembled condition, in a fifth embodiment thereof;

30 Figure 8 is a cross-section view of the shoe of Figure 7 prior to final

assembly.

### Ways of carrying out the Invention

With particular reference to Figures 1 and 2, a breathable shoe according to the invention comprises, in this case, an assembly 10 which wraps around  
5 the foot insertion region and is in turn composed of an upper 11 which is breathable (for example made of natural leather without sealing pigments) and is associated with a breathable or perforated lining 12 (made for example of Cambrelle).

The lining 12 is associated with the upper 11 by spot-gluing, so as to not  
10 compromise breathability through said upper.

The assembly 10 furthermore comprises a breathable or perforated insole 13 which is joined, by means of stitched seams 13a, to the edges of said upper 11 according to the manufacturing method commonly known as "Strobel" or "ideal welt", so as to form a sack into which the assembly last,  
15 not shown in the figures, is to be inserted.

The insole 13 can be made of a material which is breathable (for example natural leather) or perforated, with an optional heel seat lining made of soft leather with absorbent rubber latex.

A membrane 14 made of a breathable and waterproof material, optionally  
20 coupled (so as to withstand hydrolysis without compromising breathability) to a supporting mesh 15 made of synthetic material, is associated with said insole 13 for example by spot gluing.

Preferably, the mesh 15 lies below the membrane 14.

The membrane 14 can be of the type that is commercially available and  
25 commonly known by the trade-name Gore-Tex.

A sole 16, formed by a single block of elastomer with through holes 16a through its thickness, is joined to said upper for example by gluing (with hydrolysis-resistant adhesives) or high-frequency welding along a perimetric band and is sealed perimetrically with respect to said membrane  
30 14.

As an alternative, direct injection of the sole 16 on the upper 11 can be provided.

A protective element 17 made of a material which is hydrolysis-resistant, water-repellent, breathable or perforated is associated below said membrane  
5 14 by spot gluing, for example by adopting a commercially available adhesive which is resistant to hydrolysis (of the kind commonly known as "hot-melt" or calendered-powder systems).

The protective element 17 can be conveniently made of a material which is water-repellent and capable of drying rapidly, such as for example non-  
10 woven fabric or needled cloth.

As an alternative, it is possible to provide a Kevlar or filtering fabric.

Conveniently, the edge 18 of the protective element 17 lies inside the edge 19 of the membrane 14 in order to allow to form a seal with the sole  
16.

As an alternative, the edge 19 of the membrane 14 can be folded around  
15 the edge 18 of the protective element 17, or said protective element could be thinned at the edge (if it has the same perimeter as the membrane 14) so as to allow the penetration of the sealing adhesive between the membrane 14 and the sole 16.

The protective element 17 protects the membrane 14 from external  
20 impacts or foreign objects which might penetrate through the holes provided in the sole 16.

A breathable or perforated inner sole 20 completes the shoe.

The shoe is manufactured by associating the membrane 14 and the  
25 protective element 17 with the assembly 10, which is constituted by the upper 11 and the insole 13 (fitted on the last), and subsequently joining the sole 16.

As an alternative, the membrane 14 can be joined to the sole 16 first and then the composite element can be associated with the assembly 10.

30 The shoe according to the invention, as shown by the description of this

first embodiment, is entirely breathable, any non-breathable regions being limited substantially to the perimetric regions of the sole, which must in any case ensure a good seal with respect to external moisture and water.

With particular reference to Figure 3, in a second embodiment the shoe  
5 differs from the preceding case in that the protective element, now designated by the reference numeral 117, is sandwiched between two components 116a and 116b (which are mutually joined hermetically) into which the sole 116 is divided, each component having through holes 116c and 116d.

10 This is done if the thickness of the sole 116 is so great that it is difficult to clean it of any mud or dirt which might penetrate.

Being blocked by the protective element 117, in this case, the dirt can be released purely by virtue of the flexing of the sole, designated by the reference numeral 116.

15 The part above the protective element 117 of the sole 116 can act as an air chamber which increases comfort by absorbing any unevenness of the ground and increasing the ventilation of the membrane so as to rapidly dry its lower surface, when it is wet, in order to increase its breathability.

With particular reference to Figure 4, a shoe according to the invention,  
20 in a third embodiment, differs from the preceding cases in that the sole, now designated by the reference numeral 216, has in its upper part a hollow region 220 which is delimited perimetrically by a border 221.

Dome-shaped protrusions 222 protrude from said hollow region 220, are uniformly distributed and advantageously reach the same height as said  
25 border 221.

Holes 223 or channels are provided in said border and connect the region 220 to the outside.

Each one of said holes 223 is inclined with respect to the ground contact plane, so that the outward part is lower than the inward part (this is done to  
30 avoid stagnation).



The holes 223 can furthermore be provided with one-way valves, not shown in the figures (which allow only air to flow outward).

With particular reference to Figures 5 and 6, a breathable shoe according to the invention, in a fourth embodiment, comprises in this case an assembly  
5 310 composed of a tubular upper 311 which is breathable (for example made of natural leather without sealing pigments) which is associated with a breathable or perforated lining 312 (made for example of Cambrelle).

The lining 312 is associated with the upper 311 by spot gluing, so as to not compromise breathability through said upper.

10 A membrane 314 made of breathable and waterproof material, optionally coupled (so as to withstand hydrolysis without compromising breathability) to a supporting mesh 315 made of synthetic material, is associated with the lower part of the upper 311, for example by spot gluing.

A sole 316 made of a single block of elastomer with through holes 316a  
15 through its thickness is joined to said upper 311, for example by gluing (with hydrolysis-resistant adhesives) or high-frequency welding along a perimetric band and is sealed perimetrically to said membrane 314.

As an alternative, it is possible to provide for the direct injection of the sole 316 over the upper 311.

20 A protective element 317 made of a material which is resistant to hydrolysis, water-repellent, breathable or perforated is associated below said membrane 314 by spot gluing, for example by adopting a commercially available adhesive which is resistant to hydrolysis (of the type commonly known as "hot-melt" or calendered-powder systems).

25 Conveniently, the edge 318 of the protective element 317 is internal to the edge 319 of the membrane 314 in order to allow to form a seal with the sole 316.

As an alternative, the edge 319 of the membrane 314 can be folded around the edge 318 of the protective element 317 or said protective  
30 element could be thinned at its edge (if it has the same perimeter as the

membrane 314) until it allows the sealing adhesive to penetrate between the membrane 314 and the sole 316.

The protective element 317 protects the membrane 314 against external impacts or foreign objects which might penetrate through the holes provided  
5 in the sole 316.

As an alternative, the protective element 317 can be arranged as in the second embodiment.

In another alternative, the sole 316 can be provided as in the third embodiment.

10 The shoe is manufactured by associating the membrane 314 and the protective element 317 with the assembly 310, which is fitted on the last, and subsequently joining the sole 316.

As an alternative, the membrane 314 can be joined to the sole 316 first and then the composite element can be associated with the assembly 310.

15 With particular reference to Figures 7 and 8, a breathable shoe according to the invention in a fifth embodiment comprises, in this case, an assembly 410 which wraps around the foot insertion region and is in turn composed of an upper 411 which is breathable (for example made of natural leather without sealing pigments) and is associated with a breathable or perforated  
20 lining 412 (made for example of Cambrelle).

The lining 412 is associated with the upper 411 by spot gluing, so as not to compromise breathability through said upper.

The assembly 410 furthermore comprises an assembly insole 413 which is breathable or perforated and below which the edges of said upper 411 are  
25 folded and glued (a manufacturing method known as "pre-assembled" or "AGO"), so as to form a sack in which the assembly last, not shown in the figures, is to be inserted.

The insole 413 can be made of breathable material (for example natural leather) or perforated material, with an optional heel seat lining made of soft  
30 leather with absorbent rubber latex.

The assembly 410 also comprises a breathable or perforated filler layer 413a (made for example of felt) which is surrounded by the folded edges of the upper 411.

A membrane 414 made of waterproof and breathable material, optionally  
5 coupled (so as to withstand hydrolysis without compromising breathability) to a supporting mesh 415 made of synthetic material, is associated with said filler layer 413a for example by spot gluing.

The mesh 415 is preferably in an upward region with respect to the membrane 414.

10 The membrane 414 can be of the commercially available type commonly known by the trade-name Gore-Tex.

A sole 416 formed by a single block of elastomer with through holes 416a through its thickness is joined to said upper for example by gluing (with hydrolysis-resistant adhesives) or high-frequency welding along a  
15 perimetric band and is sealed perimetrically with respect to said membrane 414.

As an alternative, it is possible to provide for the direct injection of the sole 416 on the upper 411.

A protective element 417 made of hydrolysis-resistant, water-repellent,  
20 breathable or perforated material is associated below said membrane 414 by spot gluing, for example by adopting a commercially available adhesive which is resistant to hydrolysis (the type commonly known as "hot-melt" or calendered-powder systems).

The protective element 417 can be conveniently made of a water-  
25 repellent material which is capable of drying rapidly, such as for example non-woven fabric or needled cloth.

As an alternative, it is possible to provide a fabric made of Kevlar or filtering fabric.

Conveniently, the edge 418 of the protective element 417 lies inside the  
30 edge 419 of the membrane 414 in order to allow to form a seal with the sole

416.

As an alternative, the edge 419 of the membrane 414 can be folded around the edge 418 of the protective element 417 or said protective element could be thinned at its edge (if it has the same perimeter as the membrane 414) until it allows the sealing adhesive to penetrate between the  
5 membrane 414 and the sole 416.

The protective element 417 protects the membrane 414 against external impacts or foreign objects which might penetrate through the holes provided in the sole 416.

10 As an alternative, the protective element 417 can be arranged as in the second embodiment.

In a further alternative, the sole can be provided as in the third embodiment.

The shoe is manufactured by associating the membrane 414 and the  
15 protective element 417 with the assembly 410, constituted by the upper 411, the assembly insole 413 and a filler layer 413a (mounted on the last), and subsequently joining the sole 416.

As an alternative (Figure 8), the membrane 414 can be joined to the sole 416 first and then the composite element can be associated with the  
20 assembly 410.

In practice it has been observed that the present invention has achieved its intended aim and objects.

A shoe with a waterproof and breathable sole has in fact been provided by using the "Strobel", "ideal welt", "pre-assembled" and other classic  
25 methods (modified appropriately) in a simpler manner than shoes known in the state of the art.

It should also be observed that the shoe according to the invention perfectly fulfills the need to have optimum exchange of heat and water vapor between the internal microclimate and the external one, while  
30 maintaining a complete impermeableness to water and moisture.

It is observed that all this has been achieved while maintaining a shoe structure which is highly flexible and adaptable to any type of styling and to any aesthetic and economical level required by the market.

It is also observed that the structure of the shoe according to the  
5 invention can be easily mass-produced, since the operations can be fully automated.

It is further observed that the structure of the shoe according to the invention allows a certain flexibility as regards the association of its components, thus leading to considerable production savings in relation to  
10 its flexibility and adaptability to the various manufacturing situations and conditions.

The present invention is susceptible of numerous modifications and variations, all of which are within the scope of the inventive concept; all the details may furthermore be replaced with other technically equivalent  
15 elements.

The material, as well as the dimensions, may be any according to requirements.

The disclosures in Italian Patent Application No. PD2000A000091 from which this application claims priority are incorporated herein by reference.

CLAIMS

1. A breathable shoe, characterized in that it comprises the following combination of elements:

-- an assembly (10;310;410) which wraps around the foot insertion  
5 region and comprises a breathable upper (11;311;411);

-- at least one membrane (14;314;414) made of a material which is waterproof and breathable and is associated with said assembly (10;310;410) in a downward region;

-- a sole (16;116;216;316;416) made of perforated elastomer, joined to  
10 said upper (11;311;411) and sealed perimetrically to said membrane (14;314;414);

-- a protective element (17;117;317;417) made of a material which is resistant to hydrolysis, water-repellent, breathable or perforated, arranged below said membrane (14;314;414) in a region between the upper part of  
15 said sole (16;116;216;316;416) and its internal part which is adjacent to the ground contact surface.

2. The shoe according to claim 1, characterized in that said assembly (10) that wraps around the foot insertion region is composed of an upper (11) and a breathable or perforated insole (13) which is sewn to the edges of said  
20 upper (11) according to the manufacturing method per se known as "Strobel" or "ideal welt" so as to form a sack.

3. The shoe according to claim 1, characterized in that said assembly (310) is constituted by a breathable tubular upper (311).

4. The shoe according to claim 1, characterized in that said assembly  
25 (410) is composed of:

-- a breathable upper (411)

-- a breathable or perforated assembly insole (413), under which the edges of said upper (411) are folded and glued so as to form a sack

-- a breathable or perforated filler layer (413a) which is surrounded by the  
30 folded edges of said upper (411).

5 5. The shoe according to claim 1, characterized in that said sole (16;316;416) is made of a block of elastomer with through holes (16a;316a;416a) through its thickness, is joined to said upper (11;311;411) along a perimetric band and is sealed perimetrically to said membrane (14;314;414).

6. The shoe according to claim 1, characterized in that said sole (216) has, in its upper part, a hollow region (220) which is delimited perimetrically by a border (221), protrusions (222) protruding from said hollow region (220), and holes or channels (223) being formed in said  
10 border (221) and connecting said hollow region (220) to the outside.

7. The shoe according to claim 6, characterized in that each one of said holes (223) is inclined with respect to the ground contact plane so that the outward part is lower than the inward part.

8. The shoe according to claim 7, characterized in that said holes (223)  
15 have one-way valves which only allow air to flow outward.

9. The shoe according to one of claim 1, characterized in that said sole (16;116;216;316;416) is joined to said upper (11;311;411) by gluing with hydrolysis-resistant adhesives or by high-frequency welding.

10. The shoe according to claim 5, characterized in that said sole  
20 (16;116;216;316;416) is joined to said upper (11;311;411) by direct injection in a mold.

11. The shoe according to claim 1, characterized in that the edge (18;318;418) of said protective element (17;117;317;417) lies inside the edge (19;319;419) of said membrane (14;314;414) in order to allow to form  
25 a seal with said sole (16;116;216;316;416).

12. The shoe according to claim 1, characterized in that the edge of said membrane (14;314;414) is folded around the edge of said protective element (17;117;317;417).

13. The shoe according to claim 1, characterized in that said protective  
30 element (17;117;317;417) is thinned at its edge if it has the same perimeter

as the membrane (14;314;414), so as to allow the sealing adhesive to penetrate between said membrane (14;314;414) and said sole (16;116;216;316;416).

14. The shoe according to claim 1, characterized in that said protective  
5 element (17;117;317;417) is made of a material which is water-repellent and capable of drying rapidly.

15. The shoe according to claim 1, characterized in that said protective element (117) is sandwiched between two components (116a,116b) which are mutually joined hermetically and into which said sole (116) is divided,  
10 each component (116a,116b) having through holes (116c,116d).

16. The shoe according to claim 1, characterized in that said protective element (17;117;317;417) is made of Kevlar fabric or filtering fabric.

17. The shoe according to claim 1, characterized in that said upper (11;311;411) is associated with a breathable or perforated lining  
15 (12;312;412) by spot gluing.

18. The shoe according to claim 1, characterized in that said membrane (14;314;414) is coupled to a supporting mesh (15;315;415) made of synthetic material.

19. A method for manufacturing a breathable shoe comprising the steps  
20 of:

providing an upper assembly (10;310;410) having a breathable upper (11;311;411);

providing a membrane (14;314;414) made of a material which is waterproof and breathable;

25 providing a sole (16;116;216;316;416) made of perforated elastomer; and

mutually attaching said upper assembly (10;310;410) and said membrane (14;314;414) and said sole (16;116;216;316;416) such that said membrane (14;314;414) is arranged between said upper assembly  
30 (10;310;410) and said sole (16;116;216;316;416) and said sole



(16;116;216;316;416) is sealed perimetrically to said membrane (14;314;414), in a manner to prevent moisture to enter into said upper assembly (10;310;410) from said sole (16;116;216;316;416) through said membrane (14;314;414), and to permit moisture to leave the inside of said upper assembly (10;310;410) through said membrane (14;314;414) and  
5 through said sole (16;116;216;316;416).

20. The method of claim 19, comprising:

initially attaching said membrane (14;314;414) to said upper assembly (10;310;410) so that said upper assembly is a unitary upper  
10 assembly (10;310;410) including said membrane (14;314;414); and

subsequently attaching said unitary upper assembly (10;310;410) to said sole (16;116;216;316;416).

21. The method of claim 20, comprising attaching said membrane (14;314;414) to said upper assembly (10;310;410) by spot gluing.

15 22. The method of claim 21, comprising:

providing a breathable insole (13) and an upper (11);

attaching said breathable insole (13) to said upper (11) by means of stitches (13a); and

attaching said membrane (14) to said insole (13).

20 23. The method of claim 21, comprising:

providing a tubular upper (311), of said upper assembly (310), having a bottom portion extending continuously between two opposite side portions; and

attaching said membrane (314) to said bottom portion of said tubular  
25 upper (311).

24. The method of claim 21, comprising:

providing a breathable assembly insole (413), a breathable filler layer (413a), and an upper (411);

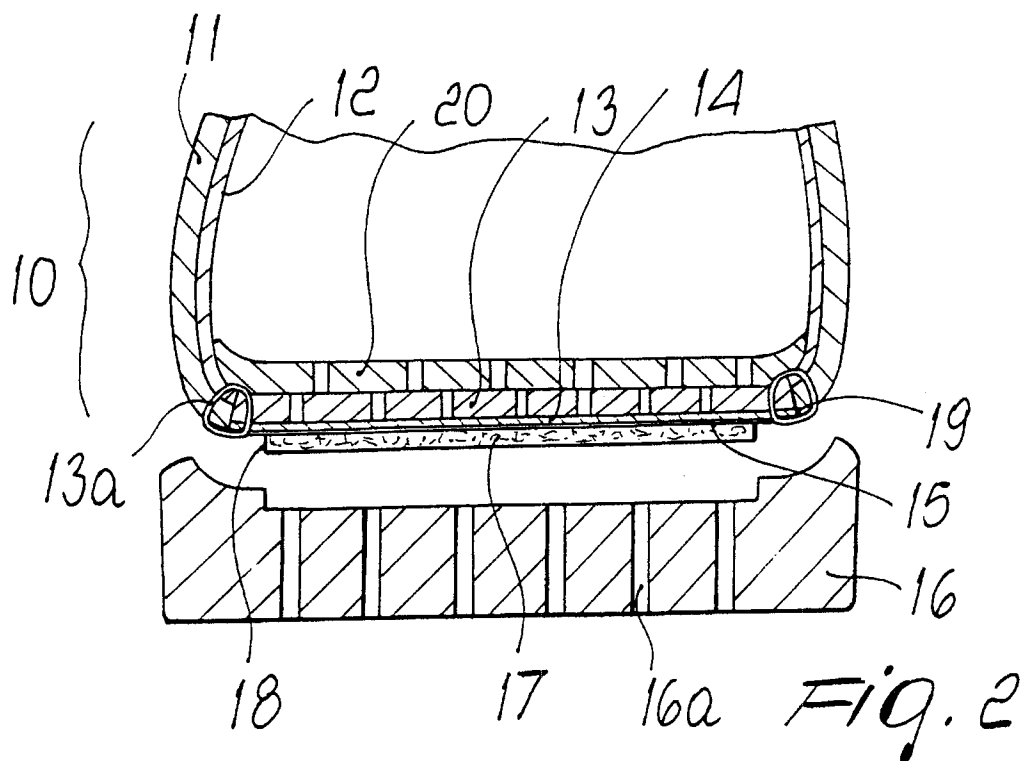
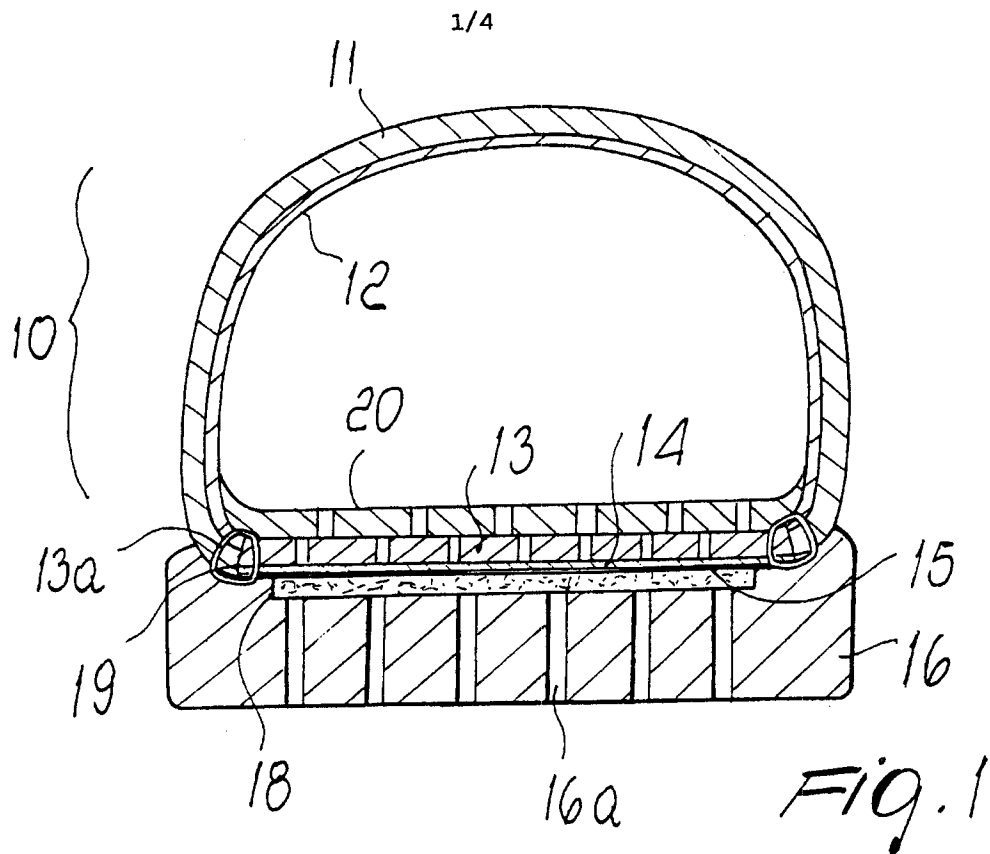
attaching folded edges of said upper (411) below said assembly insole (413), and attaching said filler layer (413a) below said assembly insole;  
30 and

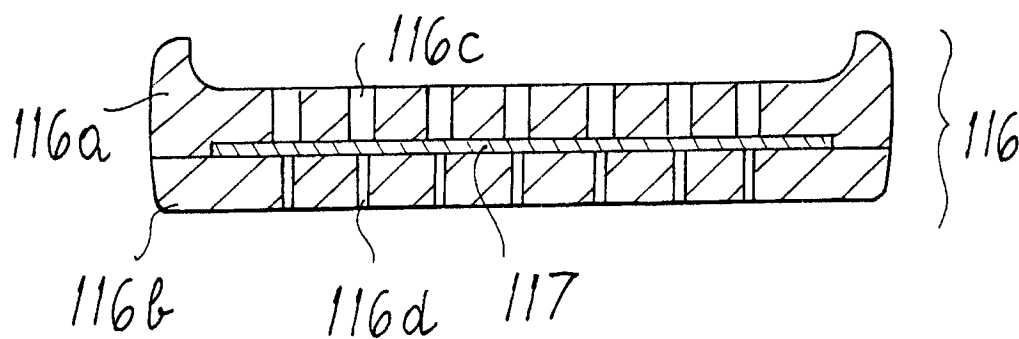
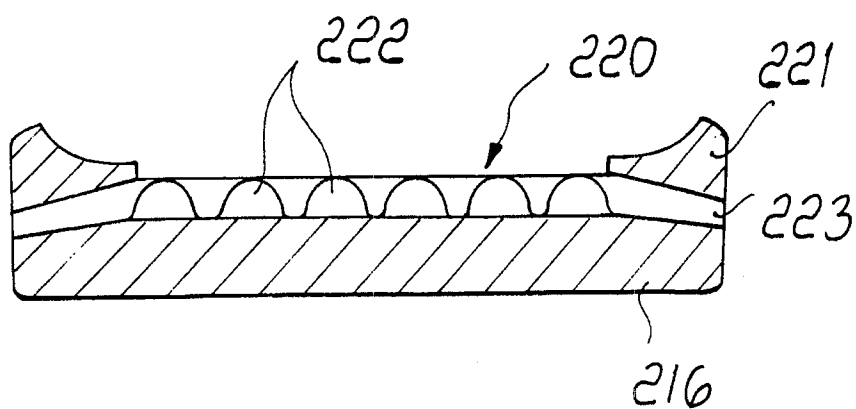
attaching said membrane (414) to said filler layer (413a).

25. The method of claim 19, comprising:

initially attaching said membrane (14;314;414) to said sole  
(16;116;216;316;416) so that said sole is a unitary sole assembly including  
5 said membrane (14;314;414); and

subsequently attaching said unitary sole assembly to said upper  
assembly (10;310;410).



*Fig. 3**Fig. 4*

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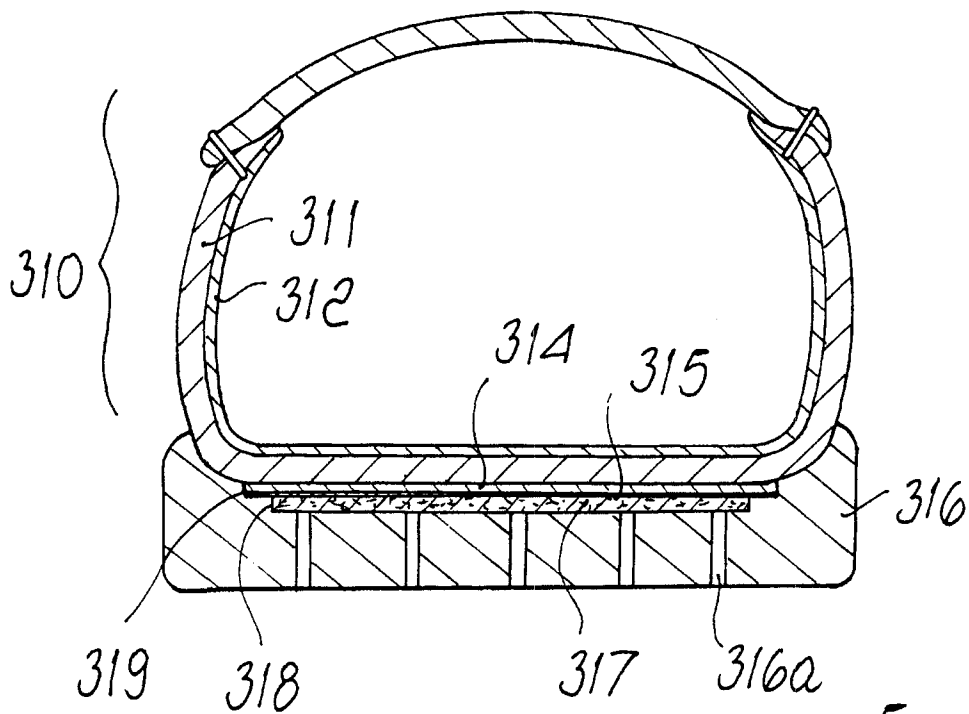


Fig. 5

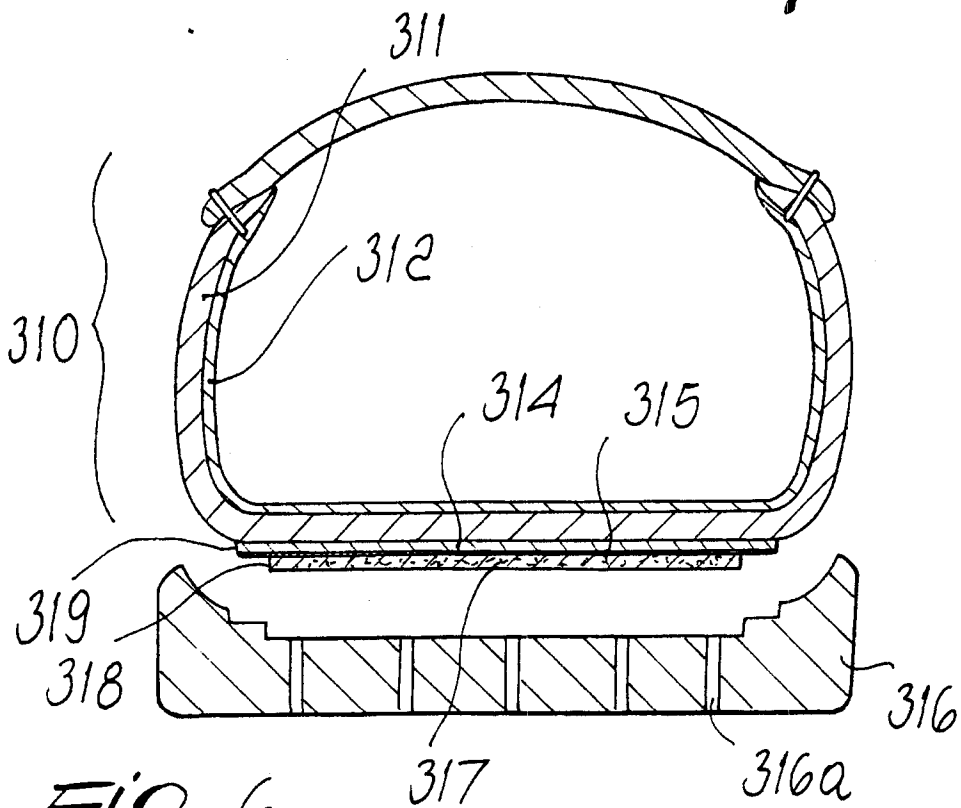


Fig. 6

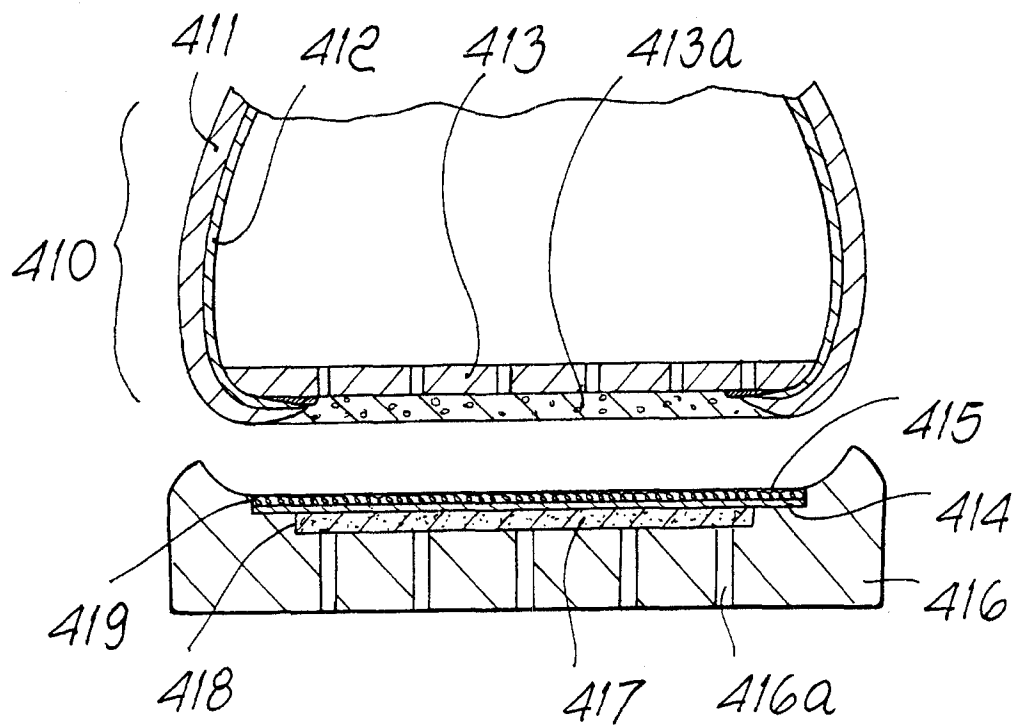
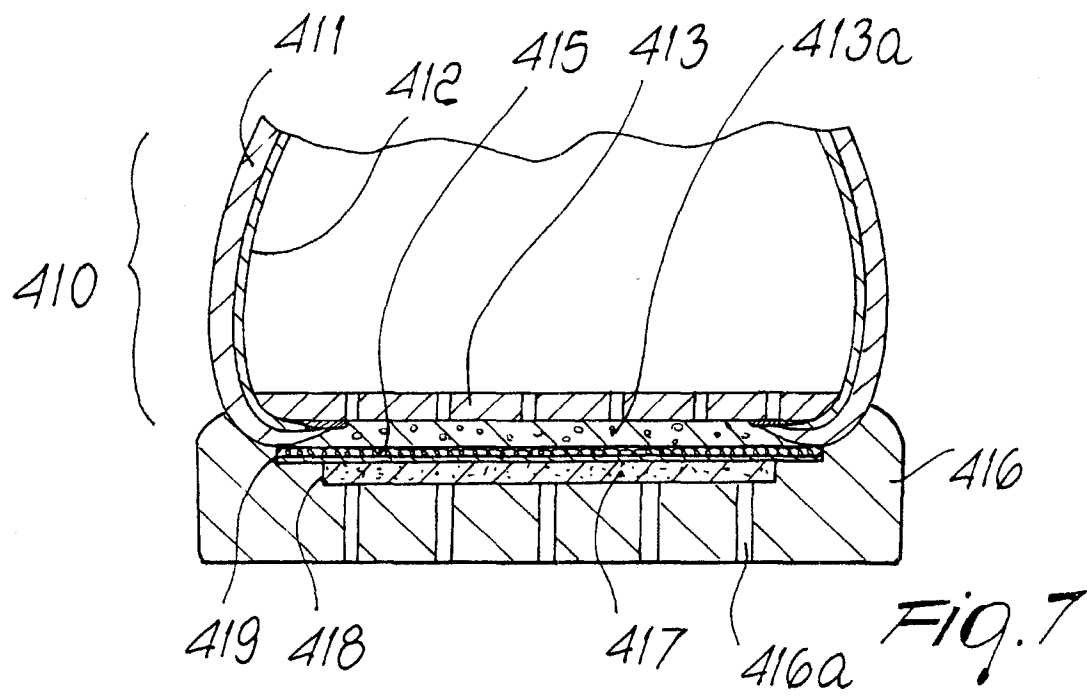


Fig. 8

# INTERNATIONAL SEARCH REPORT

national Application No

PCT/EP 01/04050

A. CLASSIFICATION OF SUBJECT MATTER  
IPC 7 A43B13/12 A43B7/08

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A43B

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 97 14326 A (NOTTINGTON) 24 April 1997 (1997-04-24) the whole document ---	1,19
A	WO 99 66812 A (NOTTINGTON) 29 December 1999 (1999-12-29) the whole document ---	1,19
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A	EP 0 910 964 A (NOTTINGTON) 28 April 1999 (1999-04-28) the whole document -----	1,19

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

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Date of the actual completion of the international search

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Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2  
NL - 2280 HV Rijswijk  
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,  
Fax: (+31-70) 340-3016

Authorized officer

DECLERCK, J

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Information on patent family members

International Application No

PCT/EP 01/04050

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